CITY OF SISTERS URBAN FOREST MANAGEMENT PLAN

INTRODUCTION

The City of Sisters' Urban Forest Management Plan (UFMP) aims to holistically and efficiently manage Sisters' urban forest and to illustrate the full scope of benefits urban trees can provide a community. These benefits provide solutions to many of the issues faced by our current society, especially in the economic, environmental, psychological, risk management and sociological areas.

The plan's various elements are addressed in many ways and through multiple management strategies. One of the primary goals of UFMP is to show how the different management strategies work together symbiotically – not independent of each other.

The Sisters UFMP offers a comprehensive approach to building and maintaining a healthy urban forest and minimizing damage caused by wildfire and invasive pests, and is comprised of five components. These components work together to build a thriving urban forest and efficient management plan, and are as follows.

(1) Trees & Infrastructure
(2) Urban Forest Management
(3) Wildfire Mitigation and Fuel Treatments
(4) Management of Tree Inventory Outside of City Limits
(5) Community Engagement & Involvement

Sisters Urban Forestry Management Plan (UFMP) presents a cost effective management plan, preserves the existing canopy cover, substantially grows canopy and maximizes benefits. Every opportunity to "do more with less" is stressed in this plan, and the budget recommendations will focus on overall efficiency while gaining a remarkable return on investment.

This plan represents an impartial overview of the current structure and offers management strategies that focus on increasing work productivity while addressing issues related to risk and liability including wildfire preparedness.

An important component to the efficiency of this plan is the immediacy of its implementation. This is because Sisters' urban forest is particularly vulnerable to forest fires and a variety of forest pests such as the Mountain Pine Beetle. The sooner recommendations are implemented; the more prepared Sisters will be for such an event. Without immediate action, Sisters urban forest will be compromised, which will limit the City's ability to respond to or handle large-scale impacts from forest fires, invasive pests as well as high windstorm events, urban development and risk management.

MISSION STATEMENT

The City of Sisters is committed to providing a healthy, safe and aesthetically pleasing urban forest for its residents and visitors. By maintaining, managing and preserving its trees, the City raises its citizens' standard of living and maximizes the benefits offered by its urban forest.

VISION STATEMENT

Sisters' urban forest is an essential component of municipal infrastructure, one that creates efficiencies and long-term solutions to achieving a safe and sustainable community. The community forest is cared for by the City and its citizens, creating a high quality of life, a healthier environment and making it a leader among other central Oregon cities.

HISTORY & THE SISTERS OF TODAY

Sisters' economic and social history is in agriculture and timber.

Located at the foot of the Cascade Mountains in majestic Central Oregon of Deschutes County, the Sisters of today is a destination community that offers unparalleled natural beauty, endless recreational opportunities and authentic western charm.

Situated along U.S. Highway 20 just northwest of Bend, it serves as a gateway to the Central Oregon region. It is renowned for its local attractions including Hoodoo Ski Area and prominent community events such as the Sisters Rodeo, the Sisters Outdoor Quilt Show and the Sisters Folk Festival.

Sisters has a strong social fabric with residents who are passionate and active in the community and who welcome involvement in policy- making processes. With its many family- oriented opportunities (outdoor activities, sports, etc.) and one of the best performing school districts in the state, Sisters offers a fantastic environment in which to raise kids. Sisters offers the unique combination of small-town living with larger-city amenities including numerous restaurants, shops, galleries, golf courses and a movie theater.

The local economy supports vibrant and diverse tourism opportunities in and around Sisters. In addition, it serves as an economic center for many small and mid-sized companies in a broad range of industries such as bioscience, telecom, green energy, high tech, outdoor equipment and the industrial arts.

CLIMATE & ENVIRONMENT

The following information is based on averages, not absolutes.

Sisters' climate zone is primarily characterized as a 6a. There are 11 designated hardiness zones, with 1 being the coldest climate and 11 being the most moderate zone.

Sisters receives approximately 11 inches of rain per year. The US average is 38 inches of rain per year. Sisters averages 16 inches of snow per year. The US average is 28 inches of snow per year. On average, there are 162 sunny days per year in Sisters. The US averages 205 sunny days.

Sisters gets precipitation, on average, 73 days per year. Precipitation is rain, snow, sleet, or hail that falls to the ground.

Weather Highlights:

Summer High: the July high is around 84+ degrees
Winter Low: the January low is 23
Rain: averages 11 inches of rain a year
Snow: averages 16 inches of snow a year
Average Growing Season – Sisters average growing season is 75 – 85 days.

Soils – Most Central Oregon soils are course with a sandy texture, and tend to be sterile with minimal organic matter. These soils typically need to be amended with organic matter such as compost or aged manure to improve water-holding capacity, increase microorganism activity levels, and improve the overall health of the soil. The soil pH level is generally between 6.0 and 7.0, which is neutral and suitable for most plants. In some areas, the soil may be a bit more alkaline (pH above 7.0) and require soil amendments to reduce the pH.

Precipitation - Typical High Desert natural precipitation ranges from 8–22 inches per year, most of which falls during winter as snow.

Elevation – Sisters elevation is 3,180 feet above sea level.

POPULATION INFORMATION

The current population of Sisters, Oregon is 3,220 based on projections of the latest US Census estimates. The last official US Census in 2010 recorded the population at 2,038. This is an approximate growth rate of 42.05% since 2010. Sisters employs one contract urban forester who spends approximately 18% of his time on Sisters Urban Forest related issues over a 22 workday in an average 30 day month. As Sisters continues to grow, the urban forestry program must keep pace with the amount of development and increasing demand to remove trees.

VALUE OF URBAN FOREST

Urban forest management is a relatively new, yet important, concept across the United States, as well as in Sisters. This is due to the change in how we, as a community, value our trees. New studies and developments show clear ties to mental, social and physical health benefits from an urban forest.

In addition, the ecological benefits of having trees in an urban environment are now more important than ever. Because of this greater understanding, managing an urban forest has evolved from the number of trees and just how often they need pruning to now figuring out how the community can receive – and sustainably grow – the greatest benefits possible from Sisters' urban forest.

Implementing recommendations from this proposed plan will benefit Sisters particularly well. This is because Sisters has a resource in its urban forest that has much potential, meaning the true benefits of the urban forest have not been maximized. A sustainable urban forest will mean a stronger community in Sisters. By investing in the urban forest and implementing the plan, the City of Sisters can achieve a cost-effective, long-term solutions to human and environmental issues. Such as:

- Improve air and water quality
- Minimize stormwater run-off
- Assist in minimizing climate change and increase environmental health
- Assist with improving human health and welfare
- Increase health and biodiversity of the urban forest
- Minimize impacts of land use development
- Create shelter and food sources for wildlife
- Differentiate Sisters from other central Oregon towns by further establishing itself as a leader in sustainable practices
- Reduce energy use

It is now more important than ever to invest in the future of Sisters because of the need to improve human health and welfare. This plan offers realistic, achievable solutions to critical community issues; however, if Sisters is to realize the full array of environmental benefits, a belief or thought paradigm shift needs to take place. Sisters urban forest needs to be thought of as an essential component of Sisters' infrastructure and must be included in the planning of Sisters growth and development.

It is difficult to grow an urban forest when it is implemented as an afterthought. Sisters is well positioned to implement many of the recommendations made in this report in a relatively quick timeframe. This is due to receptive community members and growth in Sisters.

ORGANIZATION OF PLAN

This plan first provides the background and context necessary to understand why an urban forest is beneficial to the community that lives in it and why a plan is needed to achieve the principles of a sustainable urban forest. Once this background is understood, five management components are analyzed. These components are:

Tree Infrastructure – This includes an assessment of the current conditions and characteristics of the urban forest.

Management of the Urban Forest – This includes the people and departments charged with caring for and implementing this plan. Such entities include designated city employees, elected officials and Sisters Urban Forestry Board.

Wildfire Mitigation and Fuel Treatments – We will examine how pre-fire mitigation activities and coordination with our agency partners can help reduce the harm from future wildfire events to people, property, natural resources and infrastructure.

Management of City Owned Forest Lands Outside of City Limits – Due to location and size city owned forest lands outside of city limits may be suitable for commercial forestry management.

Community Engagement – This is the relationship between the City of Sisters and the community. This management component shows the important role the city has in engaging the public to raise awareness of the urban forest, given that at least half of the urban forest is on private property.

After analyzing each of these components, the plan makes recommendations on how to improve in that area.

PLAN'S GOALS

The goal of this plan is to coordinate the management of Sisters' urban forest. The plan addresses environmental considerations; clarifies roles and responsibilities; and provides tools for implementation, such as action items and suggested time frames. This plan creates a holistic urban forest. One that:

- Enhances the City of Sisters through environmental and economic benefits
- Is resilient to climate change, forest fires and invasive pests
- Is valued by the community as an essential resource and asset

A sustainable urban forest is one that is healthy, diverse, continually being added to and well adapted to the local climate and urban conditions. A healthy urban forest requires maintenance and this plan seeks to find the most cost-effective way of maintaining the urban forest.

A diverse urban forest has a variety of species, which contributes toward resilience in the event of insects and disease, as well as offers a rich canopy in various sizes and appearance. Continuous planting will ensure trees grow to maturity at different stages and will strengthen the age diversity of the urban forest.

A well-adapted urban forest is one that uses species that are resilient to insects and urban conditions and suited to withstand central Oregon's cold winters and hot summers.

This plan has six essential elements, and if implemented correctly, will save the City of Sisters time and money in management costs, preserve the existing canopy and greatly expand the urban forest and the benefits it provides. Five of these elements directly prepare Sisters for an increase in damaging insects and disease. The sixth element expands and reduces liability. The six essential elements are:

- Plant a new generation of trees with appropriate species diversity that assists with reducing fire risk, Etc., exclude fruit bearing trees like crab apple, etc.
- Establish a systematic and coordinated detection process for Mountain Pine Beetle discovery and other damaging pathogens.
- Actively remove trees that are deemed fire fuel, hazardous, in poor condition or in inappropriate locations
- Establish a healthy and vibrant relationship between the community and Sisters Urban Forestry Board
- Complete and maintain a comprehensive tree inventory analysis / report
- Implement a proactive maintenance cycle to help reduce ladder fuels

The plan is not organized around these elements, rather they are addressed in many ways and through multiple management strategies throughout the plan. When necessary, they are highlighted to show how the three management components (tree infrastructure, urban forest management plan and community engagement) work together symbiotically – not independent of each other.

If a large Mountain Pine Beetle infestation were to spread across Sisters without these essential elements in place and actively used, the city would spend approximately $20,000 to $30,000 in response efforts and still potentially lose between 75 and 100 trees.

SISTERS' RELATIONSHIP WITH ITS URBAN FOREST

The urban forest in Sisters is a valued city asset for its citizens & visitors and is considered part of the city's infrastructure. The influence of the urban forest on quality of life and the town's character cannot be overstated. The significance Sisters places on its urban forest differentiates it from other towns across Oregon and makes Sisters a more attractive place for people to visit and make their home.

Sisters is well positioned as one of the most desirable places to live, visit and participate in outdoor recreation. Investing in its urban forest is an essential part of realizing this future. Ultimately, it is the people of Sisters who are the driving force in supporting this management plan.

VALUE OF URBAN TREES

Urban trees increase human quality of life in many ways. Trees in urban landscapes provide economic benefits such as increased property values, reduced demand on sewer systems through reduced stormwater runoff and erosion, enhanced air quality, carbon sequestration, energy conservation by providing shade and wind protection and noise abatement.

There are public health benefits offered by urban trees, and investing in the community forest benefits everyone, not just the privileged, thus adding an element of social justice. Other nonmonetary yet important benefits of urban trees include wildlife habitat for animals, especially birds and the higher quality of life created by having trees in the viewshed.

Public Health

Communities with a healthy urban forest will have a healthier population. People who live around trees are three times more likely to be physically active and 40% less likely to be overweight (Donovan, G.H. et. Al.). They also offer important air filtration and, as a result, purification. In a study conducted by the United States Forest Service, it was found that communities that have lost massive number of trees were linked to higher death rates. Urban trees also lower stress levels and even improve recovery time for patients when given a view of trees.

Social Benefits

Urban trees contribute to important community dynamics. Trees enhance public places such as parks and open spaces, improve street and public right-of-way aesthetics, and provide an opportunity for citizens to engage in an issue that benefits themselves, their neighbors, and the community as a whole. Studies indicate urban trees even reduce crime rates (Kuo & Sullivan, 2001). Many transportation officials argue that urban trees promote a safer and sustainable transportation system. Tree lined roads and streets tend to slow vehicle traffic and help guide motorists, making them physically safer by providing a barrier, and thus creating a naturally convenient design in transportation (Tarran, 2009).

Hydrology

Urban trees work symbiotically with other parts of the city infrastructure. Urban trees reduce the demand on sewer systems during periods of stormwater runoff. Tree canopies absorb rainwater, lessening the amount of water entering the sewer system. Much of the water that runs down the trunk of a tree is absorbed by the roots. As much as 80% of rainfall in the summer months can be absorbed by trees on impervious surfaces (Stringer & Ennos, 2013).

Rain is intercepted by a tree's canopy, it does not impact the soil, thus limiting erosion. These valuable soils are retained, and the sewer system does not have to process the particulate matter. Trees also increase the soil's capacity to store rainfall through transpiration, and they increase soil organic matter.

Trees can also provide energy conservation in an urban environment. This is done by shading buildings from the summer's sun and insulating them from wind. Deciduous trees are able to absorb radiant energy from the sun in the summer, yet in the winter they allow it through their leafless branches.

In winter, we value the sun's radiant energy, and because of this we should plant strategically around our homes and buildings to realize the best energy savings (ISA website and Matheny & Clark, 2008). Trees planted on the west and north sides of buildings dissipate winter winds coming from those directions. Air mass in a building with poor insulation can change two to three times per hour, and even in well-sealed homes, the air mass can change once every two to three hours. Trees that deflect winter wind can reduce air infiltration by up to 50%, resulting in a heat savings of 10 to 12% (Heister, 1986).

Air Quality

Trees improve air quality by absorbing gaseous pollutants such as sulfur dioxide, nitrogen dioxide, ozone and smog. Trees also intercept particles in the air associated with soil tillage, construction and erosion. These airborne contaminates have been associated with asthma, heart & lung disease and cancer. Trees sequester carbon. Over time trees grow woody material, banking the caron from the atmosphere. Trees release oxygen through photosynthesis and lower air temperatures via shading and transpiring water into air. These trees can also block undesirable views while reducing noise, especially from vehicles and construction.

Economic Value

A well-maintained urban forest creates value. A survey by Arbor National Mortgage, Inc. found that a building lot with trees would "be as much as 20% more sellable than a house on a lot without trees." Thus, investments in trees pay off in perceived values and in tax revenue from increased lot values. Mature trees also reduce street temperatures and in turn, decrease the need for street maintenance from every seven years to 10 years to every 20 years (Matheny & Clark, 2008). There is also increased benefits to businesses. Consumers in shopping districts that are shaded by urban trees tend to linger and shop longer (Matheny & Clark, 2008). These consumers are also willing to pay higher prices and tend to have greater patronage.

Landscaping with trees and plants positively influences businesses by:

- Contribute to corporate or business image
- Used as a marketing tool
- Viewed as an employee benefit
- Attract new customers or business tenants
- Increase workplace productivity, recruitment, and morale (Relf, 1996)

COMPONENT #1:

TREES & INFRASTRUCTURE

The tree canopy cover from Sisters' urban trees provides $117,230.08 in benefits annually. If no greater investment is made, these benefits will decrease. However, when invested in, the benefits grow in an exponential manner in comparison to the amount of money spent.

Sisters' tree infrastructure is an investment like any other piece of infrastructure, such as wastewater systems, water wells, sidewalks and buildings. Moreover, "unlike other public infrastructure components, properly planted and maintained trees increase in value over time." (APWA. Urban Forest Management Practices) Sisters has 707 trees recorded in parks and other public spaces. This number does not include wild trees growing along Whychus Creek and can best described as having a stocking level of 300 trees per acre. The total number of city trees, including both ROW and Parks mapped and inventoried trees is approximately 2,700.

This tree infrastructure faces new challenges due to threats from climate change and invasive pests. Climate change will result in increased storm severity, longer periods of heat and drought, lower winter temperature extremes and changing weather patterns. These factors will exploit the weaknesses of Sisters' urban forest. Addressing the health of Sisters' urban forest infrastructure should be among the highest priorities to minimize the effects of climate change and invasive insects and other pests.

The graphic below illustrates further, and quantifies actual benefits as determined from *itree* software analysis of the city limits of Sisters. *itree*, developed and promoted by the USFS, uses tree canopy coverage as viewed by remote sensing, to determine the amount beneficial properties of the urban forest landscape.

Air Pollution Benefits

Abbreviation	Description	Removal Rate (lbs/ac/yr)	Monetary Value ($/T/yr)
CO	Carbon Monoxide removed annually	1.130	$1,333.50
NO2	Nitrogen Dioxide removed annually	6.241	$436.94
O3	Ozone removed annually	48.211	$2,597.84
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	13.683	$6,268.44
PM2.5	Particulate Matter less than 2.5 microns removed annually	2.463	$106,459.51
SO2	Sulfur Dioxide removed annually	3.068	$133.85

Currency is in USD. English Units: lbs = pounds, T = ton, ac = acre

DAVEY Arbor Day Foundation SMA ISA Casey Trees Treecanopics

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SPECIES DIVERSITY

Species diversity is important to any plant population for the ecology to thrive. Single crop or monocultures harm the greater environment by inviting disease and depleting soil resources, minimizing diversification of other plant species and harming interdependent animal life.

The same principles hold true when looking at the population of trees in an urban forest. When tree species diversity is minimal, the tree population is especially vulnerable to insects and disease. If an insect or disease were to be introduced to an area and the dominant species is affected, it would devastate the tree population for that area.

Unfortunately, this is the problem Sisters' faces with its predominate Ponderosa Pine forest. The Mountain Pine Beetle could eventually kill a large number of Sisters' Ponderosa Pine trees if left untreated and diversifying tree species is not continued.

AGE DIVERSITY

Age diversity is another indicator of urban forest health. No more than 33% of one age class (young, medium, and old) should comprise an urban forest. This rule provides a basic resource structure so a younger age class is always ready to replace the older age class.

It is important when an older tree dies or is removed, a younger tree is planned in its place.
When an older tree is removed, there is a significant loss of benefits, as a large tree provides three to eight times the benefits that a small tree provides (Rogers, 2011).

Because the City of Sisters' Urban Forest Board requires tree replacement when an existing tree is removed - and these replacement trees are typically younger when planted – Sisters' urban tree forest is beginning to reap the benefits of this wise decision making. This practice needs to continue.

AGE & SIZE DIVERSITY ANALYZED

As mentioned, age and size distribution are important characteristics to the overall health of an urban forest. Public education is needed to convey the liability of planting too many of any one species. Use of the 30-20-10 species diversity rule should be utilized where the primary tree species retained and planted = 30%, the second = 20%, and the third = 10%.

Plant trees for function and performance. A large tree with a broad-leaf canopy offers more benefits over time. These trees can reach heights of 60 feet and life spans of 100 years and planting should be encouraged where root and canopy space is adequate. Small, ornamental trees that require less growing space are a wise choice where root development or overhead constraints exist.

Avoid planting fruit bearing trees in town.

INCREASING CANOPY COVER IN SISTERS

Planting new trees with species diversity is just one way to address overall urban forest health. Consistently planting trees over time addresses age diversity, while planting more trees increases canopy cover.

Canopy cover refers to the amount of land area covered by tree crowns, as viewed from the air. This figure can also describe improvements toward quality of life. For example, a tree with a large canopy in a park setting improves the park's quality because it provides an ideal spot to have a picnic or sit while taking a rest from summer activities. Similarly, trees over streets and sidewalks reduce frequency of resurfacing streets and offer cooler temperatures in the vehicles parked under them. The extent of community tree canopy cover is a good indicator of urban forest sustainability (Clark et al., 1997).

Currently between 20% and 30% of Sisters is under the canopy of private and publicly owned trees. Sisters would greatly benefit from increasing this number along its downtown street corridors. The ways to increase canopy cover are to plant more trees and protect the trees in the ground.

Planting more trees can happen with community support, education and citizen involvement. Also, enforcing city ordinances for planting requirements will increase the number of trees planted. Moreover, updating ordinances for new developments to have a plan to achieve a 33% canopy cover in 15 years will help address the goal of increasing canopy cover.

The second way to increase canopy cover is to protect the trees already in the ground so they can thrive. It is important to enforce ordinances regulating who can work on public trees. Sisters does a good job of this.

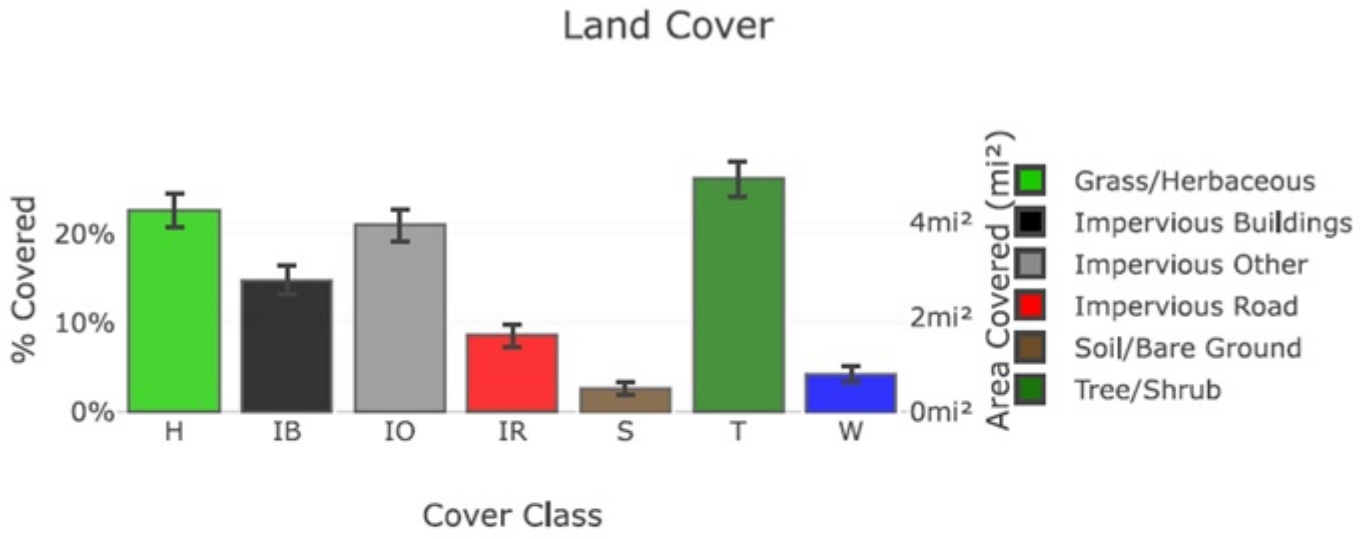
Furthermore, educating the public on reasons why they should protect their own trees is important. Street tree stand age—meaning the age of a particular generation of trees—is typically 20 to 60 years (Maco, McPherson, 2002). Thus, maintaining a consistent maximized canopy cover can be difficult because a stand will maximize its canopy and then decline. If trees in poor condition or problem trees are removed and replaced with trees that have appropriate mature canopy attributes for their location, a consistent canopy cover can be achieved.

One possible option to strengthen the tree planting program is to further develop and utilize the city-run tree lot or nursery. The City of Sisters has a nursery at the Public Works Headquarters, and cost savings can be achieved if greater use of this important resource was actively used. This program can be very cost-efficient.

A greater partnership and relationship can be formed with our local nurseries to accomplish the goal of a more species-diverse urban forest. Also, the city can be a greater resource to residents looking to plant trees on their property. These programs can be expanded to plant more trees and should focus on trying a wider variety of species.

itree software from the USFS can also demonstrate, analyze and show the amount of cover that is presently in the city of Sisters. The dark green graphic bar, and the most prominent icon is the Tree/Shrub class at 26%

and really emphasizes its standing as on of the main cover components in public and private lands as being the urban forest this plan is focused on.



Abbr.	Cover Class	Description	Points	% Cover ± SE
H	Grass/Herbaceous		113	22.60 ± 1.87
IB	Impervious Buildings		74	14.80 ± 1.59
IO	Impervious Other		105	21.00 ± 1.82
IR	Impervious Road		43	8.60 ± 1.25
S	Soil/Bare Ground		13	2.60 ± 0.71
T	Tree/Shrub		131	26.20 ± 1.97
W	Water		21	4.20 ± 0.90

Tree Infrastructure Recommendations

The following table states the primary issues needing attention, makes a variety of recommendations and provides expected outcomes. The outcomes can be used as checks to evaluate if the recommendations are providing the desired outcomes.

Issue	Recommendation	Expected Outcome
Age diversity	• Educate public as to the value of mature shade trees - Implement tree protection strategies, such as requiring site plans and building permits and enact measures to prevent or minimize damage. • Increase awareness of heritage trees. • Structure tree planting program around species diversity. • Use "Right Tree, Right Place" model as tool for education.	• Sustainable, healthy urban forest • Increased public awareness
Species Diversity	• Equip local nurseries with information on recommended planting species. • Educate public on Urban Forest Management Plan and appropriate species to plant. • Keep preferred tree planting list up to date.	• Urban Forest with higher resilience from threats to trees
Increase Number of new Plantings	• Enforce ordinances for planting street trees, especially with developers in new neighborhoods. • Maximize the amount of plantable space in developments. • Update ordinances/code for new developments with impervious surfaces to have a plan implemented to achieve 33% canopy cover over 15 years. • Incorporate planting trees into capital improvement programs, street and sidewalk improvements, and other city infrastructure projects. • Develop educational materials on the benefits of urban trees, disperse them to neighborhood meetings and public. • Explore new methods such as gravel bed plantings for tree-growing sites, community and volunteer-run nurseries, etc. • Expand tree voucher and cost-share programs and awareness of these programs. • Explore cost-share programs with schools	• Sustainable, healthy urban forest • A more robust urban forest with a better educated public making investments • Cost-effective measures implemented • Increased canopy cover • Trees better adapted to local climate.
Preserving Mature trees	• Support ordinance specification on who can work on city trees. • Develop ordinances on who can work on private trees. • Educate the public on the value of urban trees. • Create a heritage tree program to increase awareness for legacy trees.	• Increased age diversity • Improved tree protection and preservation
Sustainability and Utilization	• Explore urban wood use opportunities, i.e. use wood chips produced by tree service activities to mulch trees. Bring logs from non-diseased or non-infested removals to a space where there can potentially be creative and structural uses for them.	• Increased public relations and decreased wood waste

COMPONENT #2:

URBAN FOREST MANAGEMENT

Once the city understands the overall composition and condition of the urban forest in relation to its population, it can then decide how to best manage the resource. This is an important component of the Urban Forestry Plan because it:

- Minimizes potential for fire and insect infestation
- Keeps the citizenry safe
- Creates a healthier tree population
- Models proper tree care
- Is an area where cost efficiency is a premium and investing wisely is a priority

Current Board

The current Urban Forestry Board of Sisters has five members (Yr. 2022). The board is responsible for the oversight of all trees on city land. This includes the pruning, removal, storm cleanup and responding to maintenance calls from the public. The board is also responsible for integrating the urban forest into city planning and growing the urban forest. It is the responsibility of the Urban Forestry Board to do community outreach and education.

Homeowners and private tree care companies maintain the privately owned urban forest.
Currently the only requirement for a business to work on trees in city limits is to have a city of Sisters business license and to notify the City of Sisters Public Works Department for trees in public spaces and public rights-of-way or the Planning Department if trees are on private property.

Analysis of Current Management

The Urban Forestry Board does quality work but lacks a set of standards and specifications from which to pursue action. For example, an optimal pruning cycle is every 5 to 7 years. With its current pace, a tree will only be pruned every 13 years. Managing the municipal forest on a reactionary basis is often a challenge and ultimately unsustainable. The board does not currently have the capacity to proactively manage the urban forest. This is concerning from multiple standpoints:

- An increased level of legal liability exists from unmaintained trees.
- The trees are more susceptible to storm damage, having excessive limb load.
- The board will be ill-adapted to deal with unplanned events, such as disease or infestations.
- The department will be unable to deal with foreseeable events, such as damaging insects, disease and forest fire.

The Urban Forestry Board in Sisters is well established within the city system of government, and this relationship is beneficial. Municipal trees in the ground are rarely disturbed without consulting the board. Generally, the same is true for the public disturbing municipal trees. For the public to request work on a municipal tree, the director of the Public Works Department or his/or designee must be notified, the UFB and City Forester must approve the tree work and the person performing the work must be a certified arborist as per the ANSI Standards and the International Society of Arboriculture. This system has benefited the municipal forest.

City Forester

Finding and hiring the correct person for the city forester position to assist with implementing the UFMP will be an important task. When conducting the search, the Department of Natural Resources & conservation, International Society of Arboriculture and the American Society of Consulting Arborists have resources to assist in recruitment.

Maintaining Public Trees Inventory

Sisters has a completed inventory of public trees. Keeping track of maintenance performed on trees is important for managing the population but also for legal liability reasons. Knowing the locations of all the trees, especially the ponderosa trees, is important for developing and implementing the UFMP. It is also important to know the location of available planting spots for a new generation of trees. Managing this inventory will help track our mature tree population and save the city time with managing our urban forest.

Proactive Pruning Cycle

Setting trees up on a five to seven-year pruning rotation will increase the benefits offered by the urban forest and reflect positively on the city. Proactively maintaining the trees will reduce the workload of maintenance calls and decrease the amount of storm damage that occurs almost yearly in Sisters. Proactively maintaining the urban forest is one of the essential elements of this plan. By implementing this element, Sisters is enacting a cost-effective measure that maximizes the benefits of the urban forest. When not performing timely tree maintenance on trees, an opportunity is lost in benefits received. (Hauer, 2015)

Upon planting a tree, the cost of maintaining that tree initially outweighs the benefits received from the tree. In addition to planting costs, watering and pruning the tree for good branch structure after establishment are also costs. However, ensuring proper form and structure when trees are small is less expensive than large-scale pruning when they mature. Such neglect results in an even higher cost of either replacing a dead tree or long-term maintenance restoration pruning after storm damage or due to general weak branch attachments (Gilman, 2001). Once the tree is mature, proactively maintaining trees on a seven-year pruning rotation becomes less costly than reactive (i.e. crisis) maintenance (Hauer, 2015). The trees will still offer benefits, but with regular pruning more benefits will be realized and fewer maintenance costs will be experienced. A lack of regular maintenance results in a shorter lifespan of the tree. It also creates higher maintenance costs due to increased fire fuel, storm damage, debris, pests and branches blocking intersection or roads.

When considering this concept, an inverse relationship exists between maintenance costs and return on investment. The more trees are maintained, the lower the cost. Also, the more often trees are maintained, the higher the number of benefits provided by the trees, this a higher rate of return. The optimal pruning cycle for trees is four to five years (Miller, 1981). In Sisters, the optimal time is pushed back because of the slightly shorter growing season. The optimal pruning cycle is where the cost of maintaining the trees intersects with the return on investment.

The City of Sisters owns approximately 2700 trees, based on the trees inventoried thus far. A program to maintain the trees the city currently owns is a priority and should be implemented before new tree planning takes place.

Proactive management can be achieved by using Public Works staff as well as private contractors to perform the tree maintenance. Having the City Forester or a Certified Arborist to oversee the tree maintenance is recommended in order to wisely execute the timing and extent of the work. By implementing a proactive pruning schedule, the City Forester will set the number of trees to be pruned. At the end of the year, the City Forester will assess and review its goal regarding number of trees to be pruned and gauge the level of success. This unbiased number will represent the potential performance and efficiency of the department and thus provide measurable reports to the Urban Forestry Board and public. This yearly work plan will include all tree-related activities for street and park trees, including tree planting, maintenance/pruning, tree replacement, inspections and tree removals.

Ensuring that trees with a caliper less than 6 inches receive special attention for structural pruning will save considerable resources over time. When pruning a young tree, many long term benefits are realized by eliminating potential weak branch attachments, rubbing or crossing branches, removing co-dominant leaders, or improving the general shape of the canopy. On young trees this task can take only 10 minutes while a large tree can take much longer and is more expensive. Trees should not be pruned at planting except for dead, damaged branches or serious structure problems. It is appropriate to prune for structure after the tree has established itself for a year. By doing this, the tree will have much less liability and experience less storm damage when it reaches maturity.

Removals

Removing trees that are in poor condition or poor locations is a part of proactively managing the community forest. Keeping current on the removal schedule is an essential element of this plan because it plays a crucial role in preparing for wildfires and harmful insects and pathogens. When failing or compromised trees are detected, the removal schedule of trees in poor condition or bad locations is enacted. Thus, reducing that workload in advance will help the city tremendously.

Planting

Planting new trees and replacement trees reflects well on Sisters and creates a positive public perception. Planting a new generation of trees is an essential element of this plan. Choosing the right tree for the right place is an important consideration when planting, especially with street trees. It is important to remember that planting a large tree can deliver as much as eight times the value of a small growing tree or a medium stature tree. On Sisters streets and in parks, it is important to understand the site, how the tree will be maintained and then select the right tree. The public should be continuously aware of the availability of the Preferred Tree Planting List. The following are considerations for choosing trees at specific locations (Clark and Matheny, 2008):

- Available growing space-above ground (horizontal and vertical), below ground (soil volume), and ground level (distance to pavement)
- Light-daily and seasonal
- Wind-daily and seasonal
- Soil-structure and texture, drainage, pH, chemistry
- Surface cover-turf, mulch, herbaceous or woody plants
- Irrigation-quality and quantity
- Management-pest control
- Use-litter, canopy (above street)
- Proximity to structures to maintain adequate defensible space

Ways to encourage root growth in paved areas is to implement the use of pervious types of pavements (Volder et al. 2009; Morgenroth and Visser, 2011; Mullaney and Lucke, 2014). These pervious pavements make stormwater and oxygen available to the soils and tree roots. This approach is greatly beneficial to tree growth but also reduces stormwater runoff. Planting trees in residential parts of the city, especially in new neighborhoods, also needs to be addressed. These trees are of equal priority, and a land use developers' resources should be allocated appropriately. Trees planted in neighborhood areas will be greatly valued by the residents, and in turn they would provide care. These areas have many families that will benefit from more urban trees, and many times these trees are less susceptible to vandalism and damage. Public perception of Sisters will be higher because residents, many of whom are invested in their communities and neighborhoods, will see the direct benefits of city development requirements.

These trees have greater survival rates because the residents have an invested interest in seeing the trees reach maturity. When a tree is removed, having a plan for its replacement should be a part of the removal process. This can be as simple as enforcing ordinances or alerting the homeowner and/or neighborhood association of the tree replacement requirement.

Detection

Detection and monitoring for invasive species, disease, or wildfire hazards is an essential element of this plan. One invasive species of particular concern is the Mountain Pine Beetle. Detecting the arrival of the Mountain Pine Beetle as early as possible is very important. If the insect is detected early, more trees can be saved, which could potentially save many trees.

The City Forester should be designated as a reliable and qualified resource for the community, serving as a primary contact for suspected Mountain Pine Beetle reports. This will establish a consistent protocol. This person will coordinate with Oregon State University's Agriculture Extension' detection efforts. The importance of a diligent and consistent monitoring effort cannot be understated. Upon detection, a response plan can be implemented immediately.

Contracting Work

On certain projects, Sisters may consider contracting out work. Contracting out this work has certain advantages, as detailed below:

- Availability if Public Works staff are performing water/sewer/streets/parks work.
- Funds are paid only if work is performed to specifications and satisfaction.
- Labor is performed for peak demands.
- Contractor provides all equipment, repair, maintenance, and downtime costs.
- Insurance and workman's compensation is provided by the contractor.
- Contractor provides all training, supervision and certifications.
- Liability for damages is the contractor's responsibility.

Contractors can be used as a complement towards operations in municipal tree care. There are reputable tree services in central Oregon with certified arborists that are capable of performing any project the city might have. Also, it may be cost efficient to contract out for bulk pricing the treatment of trees with Mountain Pine Beetle infestation.

According to the booklet titled "Urban Forestry Best Management Practices for Public Works Managers: Staffing," often a combination of using both in-house personnel and contractors is chosen to ensure that the urban forest management services provided are performed at the lowest possible cost, as efficiently as possible and with the greatest level of expertise. Upon using a contractor, it is important to ensure they are qualified and maintain proper certifications, such as having an ISA Certified Arborist or similar credentials on staff. To verify ISA Certification, go to http://www.isa-arbor.com/.

Maintaining Private Trees

As the level of care of the public trees increases in Sisters, the private tree care will likely in turn, rise. This is because the city will be modeling good tree care and the private property owners will be educated through this. Also inevitably, with the implementation of this plan, the Urban Forestry Board will have a greater influence on the community, and people will be more educated as to the benefits of a healthy urban forest.

The only recommendation this plan makes as to the care of private trees is that anyone hired to work on trees, private or public, within the city limits-be a certified arborist or tree worker. If a private company is hired to perform tree work, the arborist working for the company must maintain a minimum set of credentials.

Sisters Public Schools

An area for opportunity for the city is to work more closely with Sisters School District (SSD). The schools in Sisters have their own jurisdiction as to tree care, and the city is not responsible for the planting or maintenance of trees on school property. SSD has additional concerns when planning trees on their property, such as not blocking line of sight and raised crown heights.

However, SSD still has a reliance on the city to lead and instruct on best management practices and appropriate species to plant. The city relies on SSD to provide continuity to the urban forest. For example, if the city has tree-lined streets with large canopy trees and an adjacent school property has no trees or smaller-stature trees, there is an opportunity to work with the school on planting suitable trees. The city has an invested interest in a strong working relationship with SSD, to provide expert counsel and possibly provide resources for additional plantings. Partnering with the schools will improve relationships and strengthen the ties to the community. This is a natural fit for incorporating an urban forest curriculum into the schools. For example, the city could offer presentations and information to science classes or perhaps donate removed hardwood trees for use in woodshop classes and in turn receive products such as benches to display at local parks.

Budget / Funding

Additional funding will be required to implement many of the recommendations in this report.
Budget increases will allow for the implementation of a proactive management approach. The city's urban forestry budget is approximately $10,000 to $12,000 per year. A modest budget increase would assist with implementing a more robust maintenance program focused on wildfire resiliency. A level of funding exists where an acceptable level of investment in the urban forest is made and it maximizes the benefits. "Cost-efficiency in relation to benefits provided can make a difference. Maintaining program funding is intimately tied to demonstrating the importance of the urban forest to the health, safety and economic vitality of the community and the effectiveness of the program in providing those goods and services" (Matheny, Clark 2008).

Additional ways to implement funding for community trees include (Urban Forestry Best Management Practice, 2006):

- Grants play an important role in funding the current street tree-planting program and will continue to do so in the future. The city staff or the urban forester can help apply for and acquire grants. However these are not static sources of funding and cannot be solely relied upon to support a local urban forestry program.
- Capital Improvement Project funds
- Tree work permits, development and inspection fees. When a development occurs with a private business or developers, the urban forest goals should be considered and fees assessed appropriately.
- Compensatory payments when a public tree is damaged by a car or by construction activity
- Partnerships with utilities
- Community groups
- Corporate and local business donations and sponsorships

Risk Management

Risk Management is defined as follows: "Risk is simply a measurement of the potential for uncertainty of an expected outcome, and the consequence of this deviation may either be good (resulting in opportunity) or bad (resulting in loss). The process of dealing with this uncertainty and trying to achieve the best outcome in a changing environment is the essence of risk management" (Reiss, 2004).

There is an inherent risk with all trees. We choose to live among trees because their benefits far outweigh their potential risk if managed appropriately (Rogers, 2011). Controlling risk can be articulated in five ways according to Young (2002):

- Risk avoidance. Ex. Planting the right tree in the right spot and not putting structures or people under a tree with structural defects.
- Loss prevention. Ex. Performing all regular maintenance and care such as pruning.
- Loss reduction. Ex. Having a plan to deal with emergency situations such as in a storm.
- Uncertainty reduction. Ex. Obtaining risk evaluations from qualified risk assessors or removing tree if risk level is not tolerable.
- Risk transfer. Ex. Contracting with a tree risk consultant. (Clark and Matheny, 2008)

Managing liability should be a main concern. Acknowledging that it is the duty of the city to maintain the public trees, Sisters must maintain the trees to a reasonable standard of care. Sisters must account for the hazardous tree conditions existing today or those that may develop in the future. If the standard of care falls below what is reasonable and prudent, liability resulting from injuries or damages may result. The standard of care is one component of risk management document.

When a tree is identified as having a defect or being hazardous, the factors that must be considered when deciding on the best option for that tree will include: involving the public as a legitimate partner, planning/evaluating performance and collaborating with other credible sources (Covello and Allen, 1998).

Tree Characteristics Associated with Tree Failure

Sisters has variable weather conditions, making it a place where there is a potential for tree failure. Tree characteristics and weather to consider will include:

- Unusual storms with strong winds, heavy snow/ice
- Winds or snow from prevailing direction
- Weak branch attachment
- Decay/loss of structure
- Crown decline or root decline
- Diseases associated with either: excessive end weight on branches or excessive root loss or defects
- Leaning trees and tree integrity failure

There are many considerations when deciding to remove a tree. First, the city forester's recommendations will be considered. Next, influences such as site conditions and weather, which affect the likelihood of failure, are considered. These conditions include:

- Climate and seasonal precipitation
- Site management history, including changes in grade or root injury
- Soil drainage conditions
- History of other tree failures
- Obstructions to tree development such as pavement or structures (Clark and Matheny, 2008)

Tree risk involves the potential for a tree or part of a tree to cause harm or damage to a target, and public trees are located in areas where objects and people are consistent targets. Educating the public is an important step when deciding if a tree is to be removed, as emotion can influence this decision making process.

The risk pertaining to the public could take the form of:

- Tree failure
- Infrastructure damage, including sidewalks and pavement, underground services and overhead utilities
- Line of sight along streets
- Vehicle clearance over streets and sidewalks
- Emergency planning
- People in parks or community space (Clark and Matheny, 2008)

Urban Forest Management Action Item Recommendations

This table is to be used as a quick source for a list of actions and goals to be implemented by the Urban Forestry Board and the city.

Issue	Recommendation	Expected outcome
Maintaining the urban forest and increasing the level of care	• Create a city forester position to implement Sisters UFMP • Implement a 5- 7 year pruning rotation for public trees • Focus especially on young tree pruning to diminish structural problems and pruning needs as the tree matures • Develop a plan for replacing cut trees • Incorporate open planting spots into the tree inventory. • Promote honorary or memorial tree planting - Post the vision and mission statements to motivate and remind.	• A more efficiently managed department • A healthier urban forest • An increased number of trees worked on every year
Funding for urban forestry	• Increase funding for department by increasing the tree assessment fees or implementing similar funding strategy. • Explore new funding sources. Ex. partnering w/community organizations, private organizations such as alternative energy, downtown businesses, utilities, etc. • Explore agency grants for urban forestry.	• Ability to meet present workload requirements • Efficient and timely response to the expectations of residents • Ability to successfully fulfill mission & vision
Increase the level of care of privately owned trees	• Require that tree services working on privately owned trees use qualified and licensed tree care companies. • Model proper tree care by implementing a 7 year pruning rotation of municipal trees.	• Higher level of care of the urban forest • Minimize and prevent poor tree care practices
Consistency of care in the urban forest	• Work with SSD to create common vision and build support for the urban forest. • Create a public outreach and communication plan.	• A higher level of care of the urban forest • Increased exposure and awareness to the benefits of urban forests
Support conditions conducive to tree growth	• Limit impervious surfaces where possible. • Establish monitoring schedule to inspect newly planted trees and improve grow space around existing trees (i.e. mulch, protection measures, widening cutouts, etc.) • Use pervious paving surfaces when possible. • Develop tree care adoption/watering program with residents in needed areas.	• Healthier more robust urban forest • Potentially increase lifespan of trees

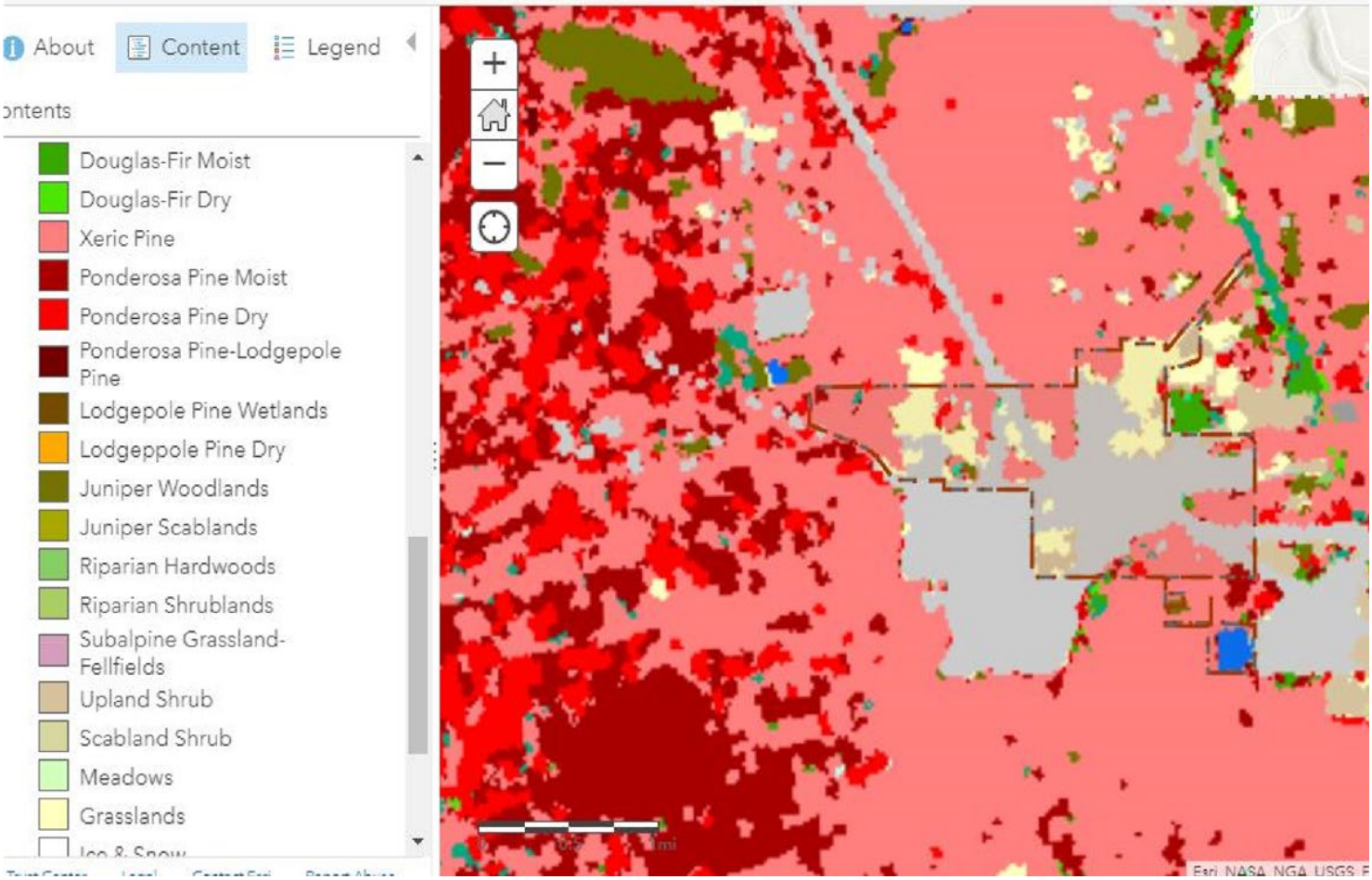
COMPONENT # 3

WILDFIRE MITIGATION & FUEL TREATMENTS

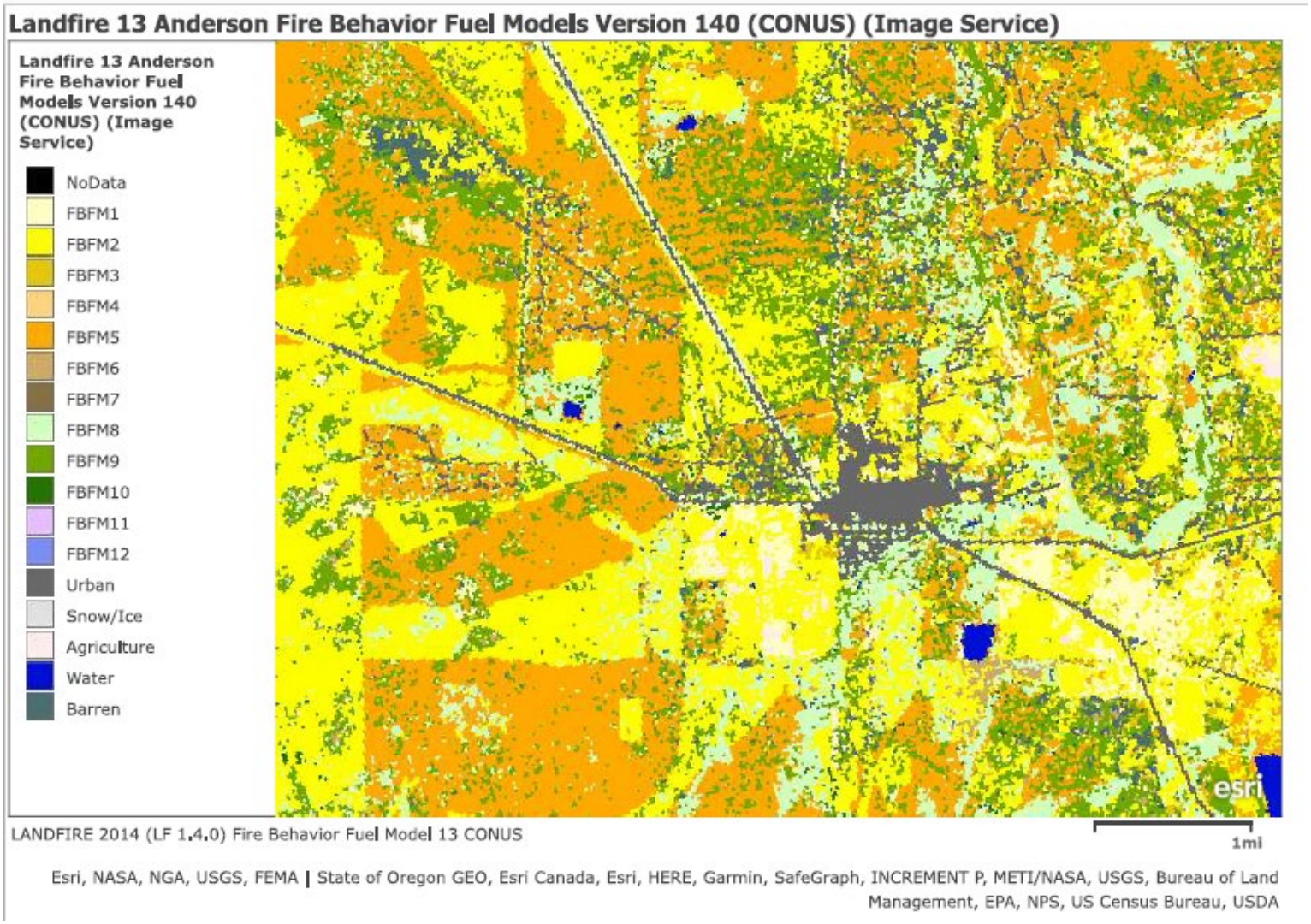
The City of Sisters is a dynamic, attractive, and identified as being a recreational destination. Currently the city is growing and includes many typical elements of most cities, however its geography and placement within close surrounding forests present unique management challenges.

Within close proximity, and in many cases sharing direct property boundaries, there are fully stocked Ponderosa Pine and mixed conifer timberlands. This convergence of urban and forest interface is truly appreciated by the residents, and all who visit. The benefits and contributions to the community are of great value. The challenges that are presented, and are very realistic, is that the potential for wildfire can in fact enter and severely encroach upon the community. Known historical seasonal fires and recent news headlines reinforce this concept. With these main points of being physically close to the forest, and the reality of that same forest being related as an identified fire prone ecosystem, there is a strong need to understand that there must be a regimented wildfire mitigation plan.

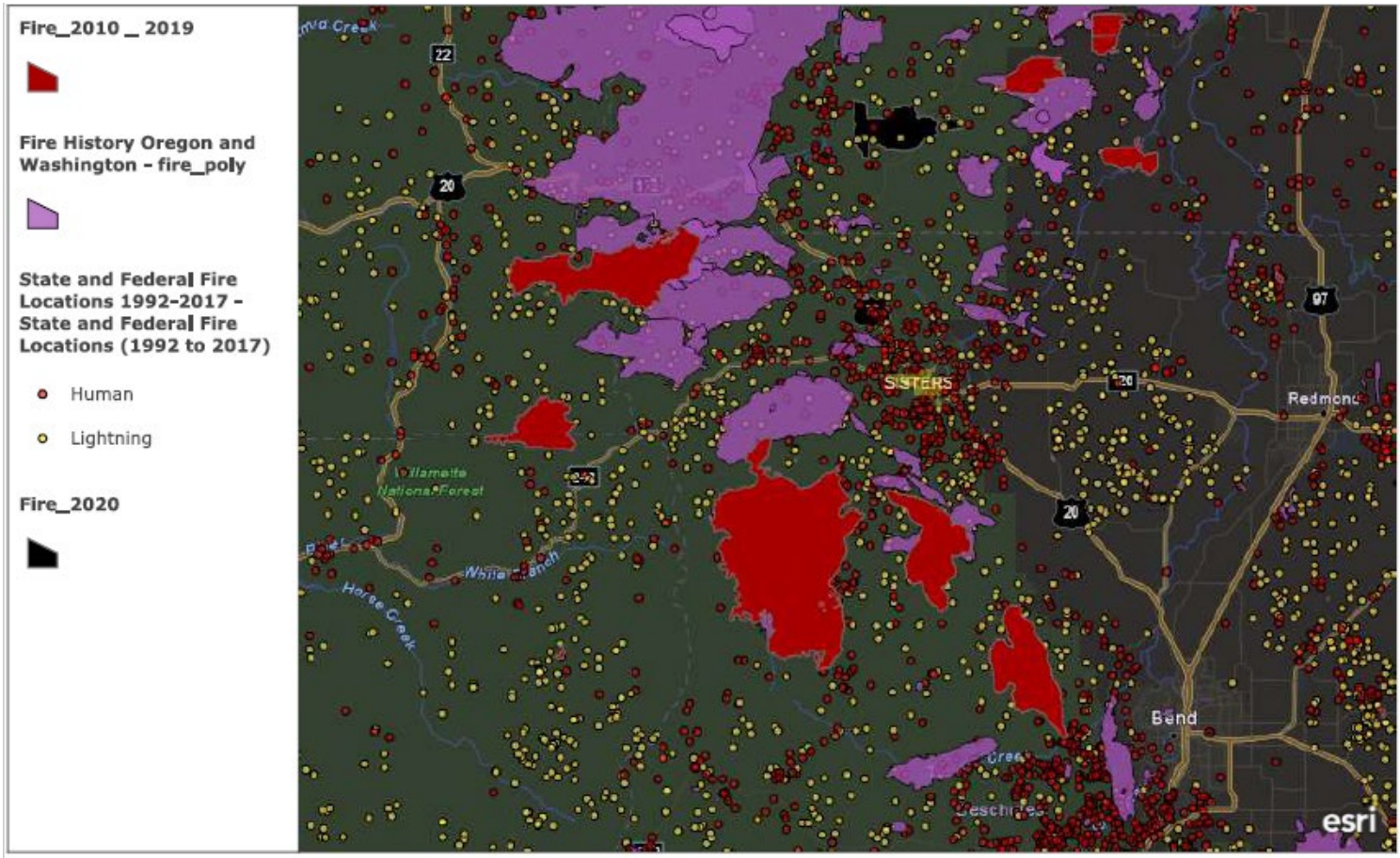
The graphic below demonstrates the relationship of the forest type proximity, and the city limits of Sisters.



This supplemental graphic compliments the forest type map, and incorporates the potential ‘fuels model’. The darker shades of yellow-brown and transitions to green indicate more volatile fuel conditions. Obviously, the regions designated as more volatile should be the focus of future fuels control treatments and collaboration with surrounding neighbors such as the USFS.



A time-line graphic further demonstrates the occurrence and the historic realistic probability of fire occurring in the region. The orange and red colors reiterate the trend of more large-scale fires now occurring in the last few decades.



Data is compiled in coordination with Northwest Coordination Center in Portland, OR. | Oregon Department of Forestry, US Forest Service | State of Oregon GEO, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA

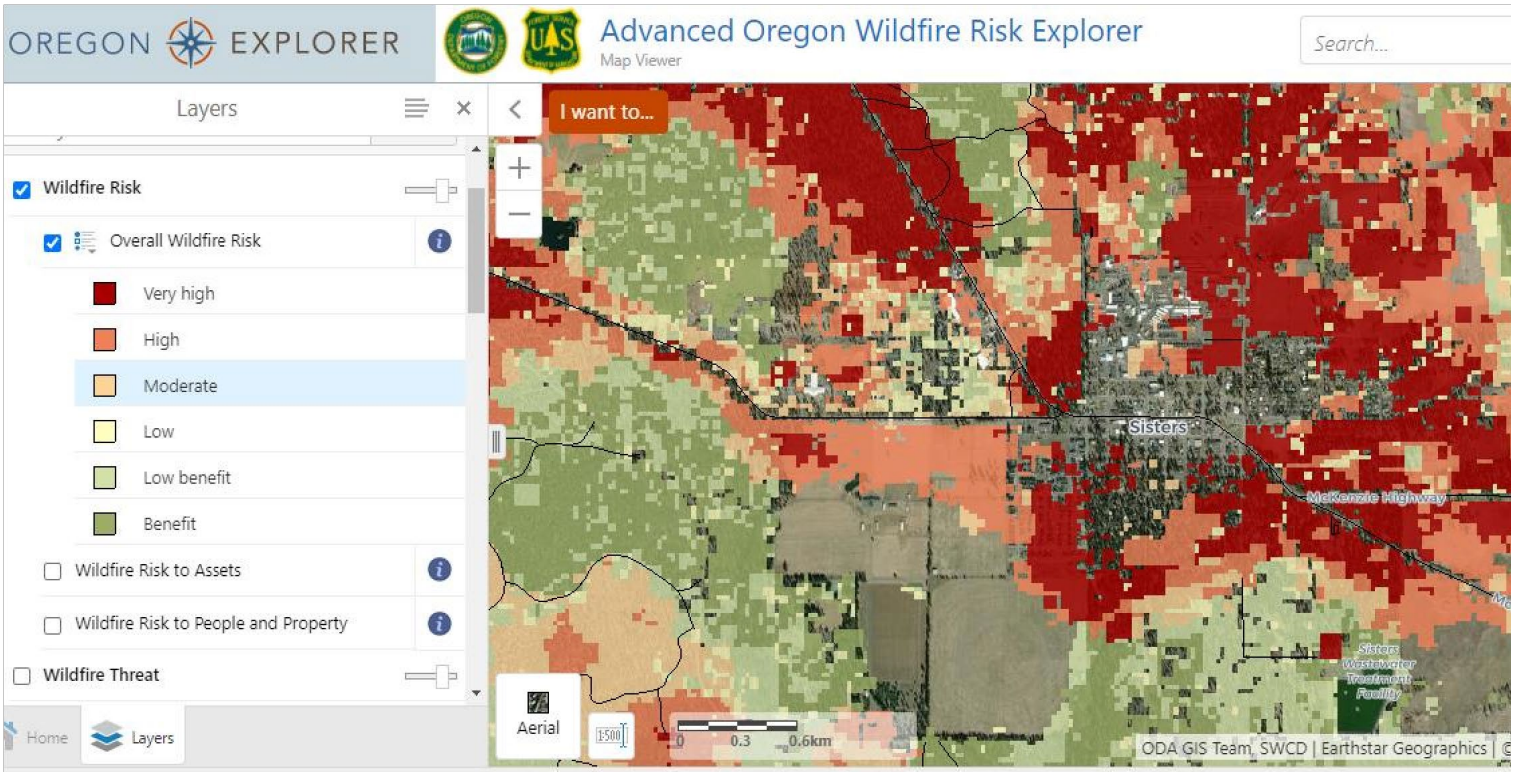
Understanding the fact that the city of Sisters resides close to fire prone forests, validates the need to incorporate a regimental and attentive need to have forest mitigation plans. One of the first steps is to understand the dynamics of the forests that surround the city. This particular segment of the document will briefly describe the ownerships directly outside the city limits. The North and East sides of the city primarily have private owners that have ranches or large lots. These areas can have mixed characteristics such as grazing fields and also have residential and agriculturally related infrastructure. They also have a considerable timber and tree cover element. The south of the city has USFS lands, but also city owned lots with significant timber. The west and north of the city has a strong and very identifiable USFS land holding.

Comprehending what is stocked on these lands is very important on how to proceed in the next steps of managing and treating the timberlands and cooperating with the city's neighbors. For general stocking and species composition, it is best if the first graphic is referred to once again. The graphic indicates the forest type of 'Xeric Pine' is the very dominate forest type.

With this general observation, it can be assumed that Xeric Pine is unlikely to be overstocked or growing to absorbent rates. Tree coverage may approach Basel Area (BA) values such as 140 or 120. Trees per acre may be approaching 200. Traditional desired values for these stands are typically 100 BA, and 150 trees per acre.

The statements preceding are general concepts and suggested levels of forest management for those types of stands. In order to fine tune and have a focused mitigation plan, an inventory of surrounding lands, or an acquisition of current cooperating owners' data is needed to fully understand the portions or particular tracts that need to be mitigated. Also, surrounding owners such as the USFS already have an active mitigation program. It is essential to parallel and follow course with their current agenda.

Basic understandings of the types of forest stockings do exist, and general conclusions can be drawn for now. With the knowledge of the surrounding forests and the current state that they are in, it can be assumed that certain areas of the city can be more vulnerable. The known stocking and density levels can be overlaid with the Sisters city limits and related infrastructure, thus more conclusions can be drawn to as where potential high levels of wildfire risk may exist. The graphic below shows this particular relationship.



The City of Sisters has several wildfire planning challenges that pose a future threat to residents and visitors. These challenges include development, proximity of a fire-dependent ecosystem near city limits, re-occurring drought conditions and a high number of tourists during fire season. To address these challenges and build on opportunities it is suggested that the City of Sisters look at these mitigation approaches:

- Define the Wildland-Urban Interface, focus on direct boundaries with city vs timberlands and USFS
- Update Defensible Space Requirements and Adopt New Wildfire Resiliency Building Code
- Use forest stocking inventories and related data from cooperators to keep tabs on conditions
- Implement Mitigation Measures on Critical Infrastructure, close to, and directly outside of the city
- Coordinate with the USFS, private landowners, ODF and Deschutes Land Trust on future mitigation measures. These public entities that already have active ongoing mitigation measures in place can help accomplish wildfire mitigation adjacent to the city limits. The City of Sisters can participate in those same measures or mirror new similar procedures on its own to accomplish the same common goal of becoming a more wildfire resilient city.
- The city can continue to perform its own treatments on its own land south of the town and match and meet the same goals as its other neighboring stakeholders.
- Additionally, Oregon Senate Bill 762 has similar directives of creating fire adaptive communities, promoting effective response to fires and maintaining a resilient landscape. The following table illustrates courses of action.
- Lastly, there must be agreement between the stakeholders to recognize an agency or entities such as Sisters – Camp Sherman Fire District or Oregon State Fire Marshall to coordinate enforcement.

Issue	**Recommendation**	**Expected outcome**
Defensible Space	• Update defensible space requirements in the Sisters Development/Municipal Code	• Fuel reduction adjacent to all structures in city limits.
Wildfire Zoning	• Adopt a wildfire hazard zone using criteria established by Oregon Department of Forestry.	• Allows city to apply wildfire hazard mitigation building codes to lots
Wildfire Resilient Building Codes	• Adopt a wildland-urban interface (WUI) code with wildfire hazard mitigation provisions for residential structures	• Gives city a new tool for improving wildfire resiliency with new development
Defensible Space	• Update Defensible Space requirements to align with current science and best practices , expand the requirements to include the entire WUI area.	• Helps address wildfire risk to developed land within and adjacent to the city
Fuel Reduction	• Work with private and public landowners to reduce fuels within the wildland-urban interface	• Provides fuel breaks that will help protect the existing stand
Tree Selection	• Develop a list of acceptable trees that are ecologically fire resistant	• Prevents the spread of wildfire within the city

COMPONENT # 4:

MANAGEMENT OF THE CITY OWNED FORESTED STANDS OUTSIDE OF CITY LIMITS

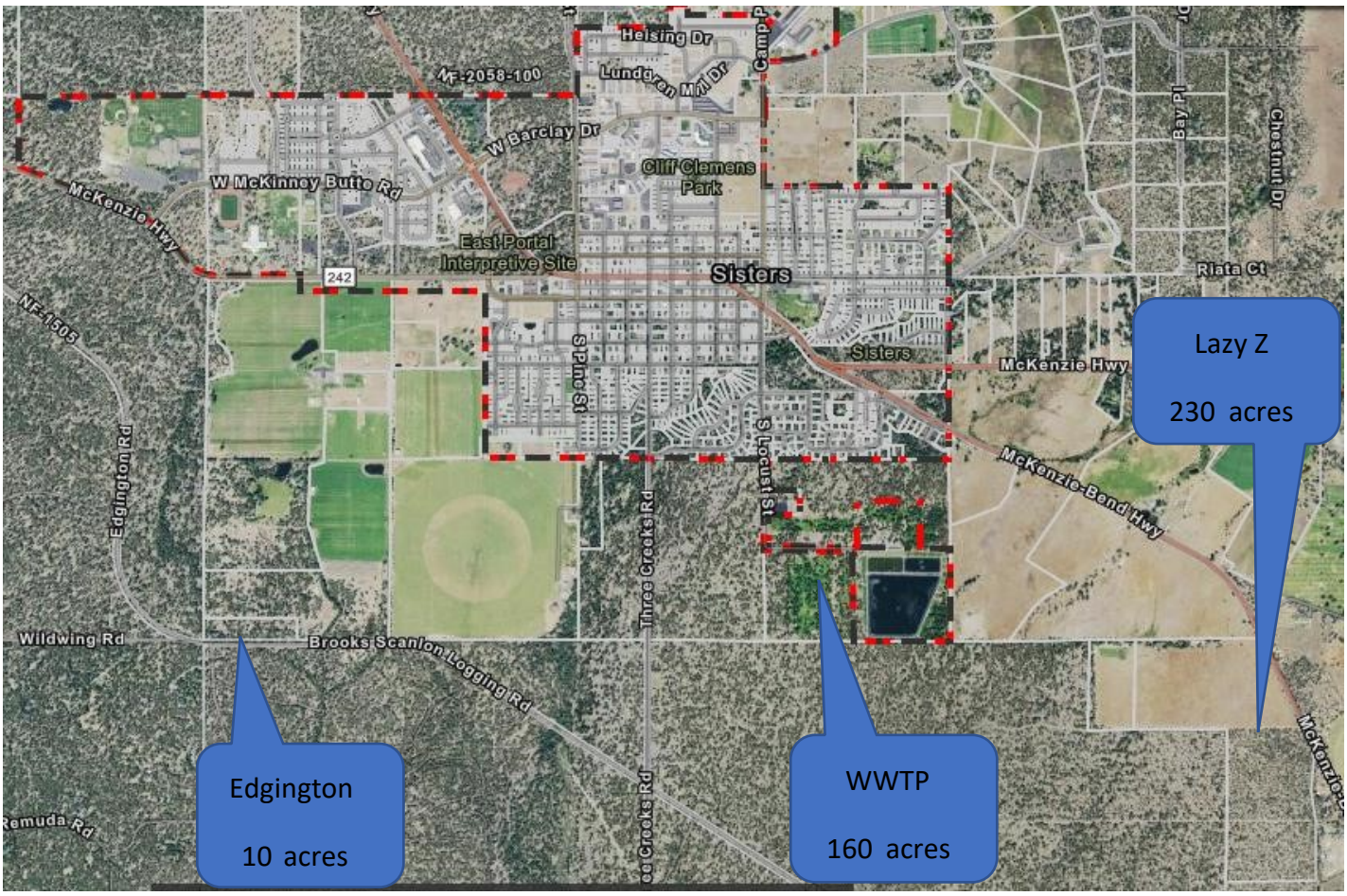
The City owns approximately 400 acres of land outside of the city limits for existing critical infrastructure and future infrastructure expansion projects. The specific plots of land are:

Lazy Z – 230 acres for current and future treated effluent disposal

Wastewater Treatment Plant – 160 acres used for the city's Wastewater Treatment Plant, Public Works Headquarters and treated effluent disposal

Edgington Road Property – 10 acre site for the development of future City owned drinking water wells

CITY OW NED PROPERTIES

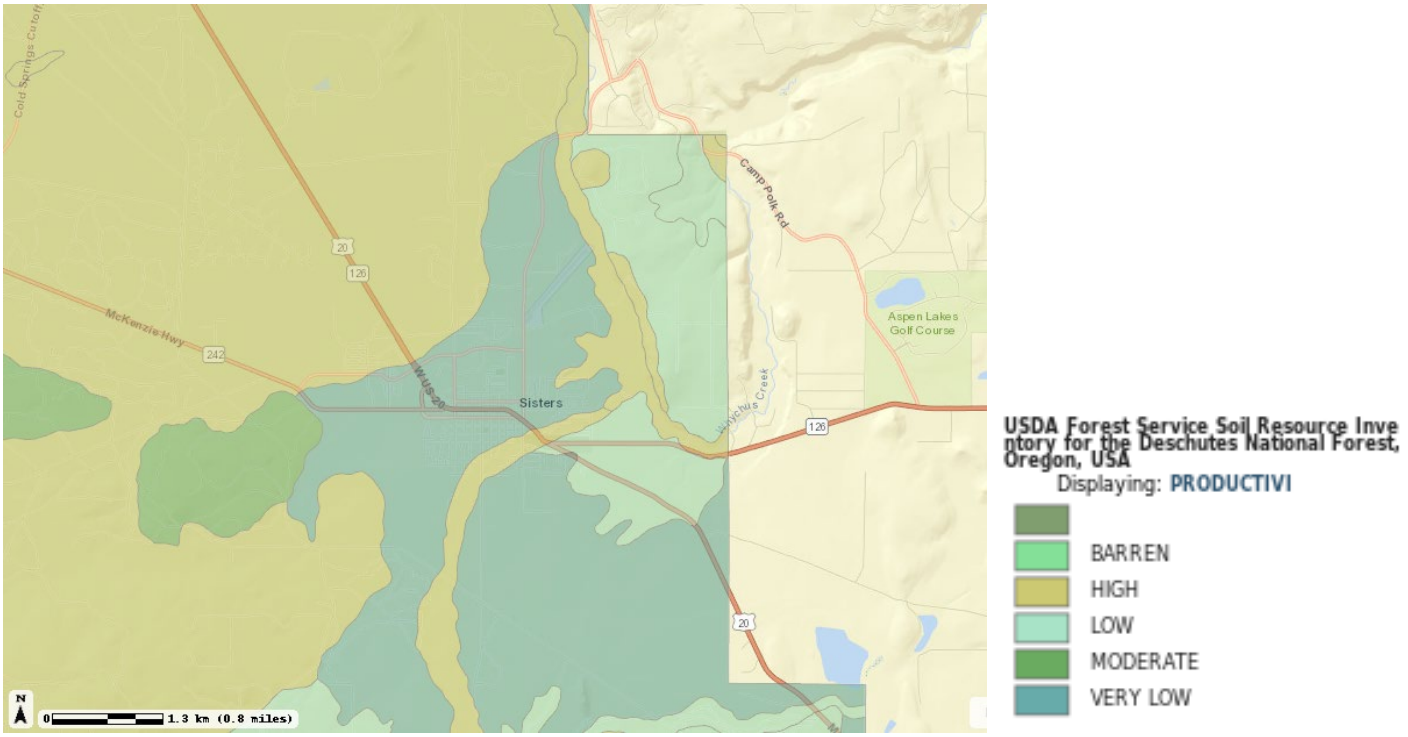


The previous graphic shows the city owned properties of which approximately 185 acres consist of 'Xeric Pine', in other words, dry pine stands.

Assumptions can be drawn, and basic listings are as follows about dry pine sites.

- Ponderosa Pine is the main species, a component of Western Juniper can also be found.
- Because the type is Xeric (dry), expectations of size parameters are 12 to 30 inches in diameter, and it is rare that heights can exceed 100 feet.
- Stocking level are typically 200 trees per acre with 120 to 100 BA (Basel Area) in unmaintained stands.
- Routine thinning and other forest operations can be performed based on stocking levels and the times of any past entries or disturbances.
- These pine stands are ecologically fire dependent. Fire outbreak will likely happen over time if not monitored. Thinning operations and prescriptions should mimic historic events, meaning thin from below and eliminate undesirable brush and lessor trees.

The overlay of publicly owned lots within the city limits can also be used to help prioritize what parcels need to be addressed.. The school district encompasses the northwest, and is already maintained and stocked with a diverse stand of primarily Ponderosa Pine. Attention can be directed to the southeast, near the Wastewater Treatment Plant (WWTP) where the stand is much denser. The WWTP is an opportunity to manage and participate in forest practices that directly complements fire mitigation plans and also has a potential to generate revenue. Based on the assumptions listed above about the common pine stands, there can be some more additional information to be sought, and used to proceed in favorable directions. A map of existing historical soil conditions can help in determining anticipated assessment procedures and courses of action, shown below:



City Forestland Inventory, Additional Details and Suggested Course of Action.

- The city has about 400 Acres of functional land for its wastewater treatment, effluent disposal and maintenance buildings.
- Subtracting infrastructure and fields on the Lazy Z, approximately 185 of these Acres is stocked with medium sized mature Ponderosa Pine and Juniper.
- Initial indications suggest the stands are fully stocked, but thinning and insect control are needed.
- A timber cruise featuring basic inventory elements and attributes such as Heights, Diameter Distributions, Trees per Acre, Basel Area are proposed. This valid and reliable sampling of the timberlands inventory will supplement the individual city tree tally

The cruise design will be as follows. For example, a grid with random plots, shown in orange, will be placed throughout the property to provide a statistical sound coverage and provide a level of confidence in the collected data.

The attributes collected, particularly the Basel Area and the Trees Per Acre calculations, will provide useful structure and guidelines, and help in prescribing future forest practices and scheduled treatments.

Typical cruise results and tally will most like support the assumptions of a fully stocked Ponderosa Pine Stand that is already approaching its full capacity, and will need thinnings and improvements in the very near future.

Scenarios and anticipated projections that are likely to be found, and brought to light:

- If trees per acre are truly to be found at currently 200, the desirable range is about 150 for Ponderosa Pine if these sizes.
- This means that about 25%, and in many cases 30%, of lessor desirable timber can be extracted from the stand.
- Stands such as these can have about 10,000 Board Feet per acre. The following table projects what the dynamics may look like. Once again, these are assumptions and pre-cruise data. *MBF equal 1000 Board Feet*

Trees Per Acre	Basel Area	Board Feet	Current Prices	Timbered Acres	Estimated Value
Pre thin 200	Pre thin 120	Pre thin 10,000			
After thin 150	After thin 90	After thin 7,500			
		Net 2,500/AC	$100/MBF Pine	185 Acres	$46,300

The table above demonstrated potential projection of timber volume and value.

With these concepts of speculation of the current forest inventory, the City is recommending to move forward with the goals of fine tuning and acquiring more data of its timberlands, proceed with designing prescriptions of forest improvements and to demonstrate to other stakeholders such as the USFS and ODF, plus our own community that the city is proactive in management of its city owned lands.

Issue	Recommendation	Expected outcome
Inventory	• Budget and perform a full timber cruise of the 185 acres	• A sound inventory of Basal Area and Trees per Acre that will help determine the need and extent of commercial thinning for a healthy stand
Thinning	• Develop a strategy and timeline to execute prescribed commercial thinning treatments	• Healthy stands that are diverse and correctly managed.
Understory Management	• Perform mowing and prescribed burn treatments to minimize ladder fuels within the stand	• Park like stands that are healthy, attractive to wildlife and are more wildfire resilient

COMPONENT # 5:

COMMUNITY ENGAGEMENT

The fifth component of a holistic, sustainable urban forestry program in Sisters is community engagement. It is the community that builds and supports its urban forest, and it's the community that reaps the benefits from the urban forest. Establishing a vibrant relationship between the community and the urban forest is an essential element in this plan and a key component to the plan's success.

More and more research show that many of the issues we face in our world today can be addressed by the urban forest. The urban forest helps combat climate change and alleviate resource demands, among other environmental issues. It also builds community, educates the youth, provides social justice, and promotes a healthy lifestyle for everyone.

The urban forest is our habitat; it is where we live. The more people that are involved, the more support the department will have, and the more resources it can draw from. A campaign that articulates the benefits of the urban forest will make it attractive and in the best interest of business to support the community forest.

Sisters' culture includes trees, which highlights the importance of community engagement. Partnering with the both community and private land use developers possibly offers the most potential in this whole plan. The key here is for the city to be a leader and a key player in this culture of trees.

Churches and civic groups often have a network of people ready to perform community projects. Having "shovel-ready" projects for these organizations would be advantageous and reflect well upon the city.

A point person for community outreach in the city will be able to keep up on the latest technology developments in social media and community engagement. The city will become a primary resource for community education, and in turn the community will develop support for the department.

A trained volunteer workforce could accomplish a multitude of tree-care activities, including planting, mulching, watering, and maintenance, and even assist in the inventory and record keeping. These records and relationships could be sourced through the forestry website.

Urban Forestry Board / Advisory Body

The Urban Forestry Board in Sisters is a wealth of talent and knowledge and an asset to the community. Here again much potential exists because the board is underutilized. Projects that would suit the board well include:

- Sponsoring and hosting informational workshops for private land use developers and the community
- Technical review of management of trees or developing management strategies
- Development of technical literature or public outreach material
- Community education programs in the schools or partnering with education groups
- Tree planting or volunteer programs with neighborhoods or interested groups
- Media relationships or developing periodic Public Service Announcements
- Assist with certain implementation phases from this plan
- Wildfire oversite of commercial forest management plan at the Wastewater Treatment Plant and city owned lands outside of city limits

This is a ready workforce that is available to the city with minimal investment. Moreover, it is likely that on certain projects, especially community events, the board members will enlist their families and/or friend networks to be involved and engaged. This group will work closely with the city forester position.

Community Planning

Trees should be considered as an essential component in the planning of Sisters' growth. Trees have special requirements for both above-ground and below-ground space. Healthy soils need to be made available as well as efficient watering mechanisms. Also, there should be a high level of awareness in regards to wildfire potential and resiliency. These elements are difficult to implement after construction has begun and are much easier to incorporate early in the planning process. An effort of outreach to designers and architects as to the importance and requirements of trees needs to take place. A strong city contact will aid in this process, both in city workings and in the private sphere.

Regular meetings should be scheduled with homeowner associations to encourage and instruct neighborhoods on how to manage their trees. The city's Planning Department will be a resource for the neighborhoods and will raise the overall quality of the urban forest by increasing the level of care of privately owned trees.

The community could be engaged through referrals to Deschutes County Forester or OSU Extension websites where they can view and perhaps contribute updates to the inventory of the urban forest. By doing this, the community can take ownership of the urban forest and see how their trees function as part of the big picture of Sisters' urban forest. There would also be an education piece for the community associated with this online inventory, furthering the goal of a healthy urban forest.

Planting Trees

Planting a new generation of trees is one of the essential elements this plan recommends for creating a healthy and sustainable urban forest. By doing this, it creates an urban forest for future generations, prepares the urban forest for the occurrence of insect or disease outbreaks, and improves the population dynamics of the urban forest in Sisters. The city currently plants many trees through its nursery program.
Instead of recommending the city budget for an increase in planting a new generation of trees, the Sisters relies on the public to incur the cost of planting the trees while being guided by the city forester. This should be done by the city forester forming relationships with largely untapped resources:

- The public
- Businesses
- School and parent organizations
- Neighborhood groups/HOAs
- Downtown Sisters and Chamber of Commerce/tourism industry
- Churches/civic organizations
- Nonprofits of every kind
- Community Health partners, and other healthcare groups
- Environmental and recreations groups, e.g. trail improvement, parks/recreation, biking, hiking, running, etc.

Forming these relationships would be the job of the urban forester. The city is maintaining more trees, integrating itself into the city workings, planting more trees, maximizing the benefits of the urban forest, and gaining support for the urban forest through public outreach and education.
To plant a new generation of trees, it is the city's responsibility to coordinate this undertaking. Once Sisters' residents know and understand the need, direction and motivation must be given by identifying the engines that will enable tree planting. Coordination needs to take place so species diversity goals are met and the groups planting trees are doing so correctly. These steps are detailed in the following paragraphs.

Education

A public information initiative must be initiated to educate the public as to the benefit of urban trees and what is at risk concerning damaging insects, hazard trees, forest fires, development requirements, Etc. Informational workshops would be hosted with school district, local plant nurseries, land use developers, neighborhood associations, Etc.

A strong emphasis will focus on promotion and outreach, and require that the community be aware of the preferred tree planting list that the city recommends.

Trees and materials will come from supportive groups, such as the United States Forest Service and the Oregon Department of Forestry. These newly formed relationships are vital towards bettering our community and must be publicly recognized to continue their involvement.

Coordination

Ultimately these newly planted trees will reflect on the integrity of the city and the Urban Forestry Board. Is there appropriate species diversity; Are the trees planted correctly and in good locations; All groups buying trees and planting trees must be educated on how to do so correctly. Possibly all the tree purchasing would be done through the City of Sisters to ensure proper species diversity. If all tree purchasing is not done through the city, then some mechanism must be set in place to accomplish species diversity.
Planting clinics can be held for those doing the planting, or an urban forestry arborist could be present at planting time to give direction and assistance. A monitoring schedule may also be necessary to inspect new tree plantings periodically in the first few years following planting. Efforts to be transparent and open about community engagement and how the city proceeds with forestry related issues can be accomplished by setting standards listed in a 'Street Tree Manual'.

This proposed manual can accompany the management plan and be used as an every-day reference document. The formality and content of this potential document can be flexible, and is really intended to be a list of guidelines typical courses of actions. Key elements to be included are:

- Summary of city tree and planting codes, paraphrased in layman's terms.
- Brief description of the Urban Forestry Board and how it functions
- Summary of the city's tree inventory. Summarized maps and basic description of attributes.
- Relationships and tie-ins to the potential Street Tree Manual should reflect back to the Management Plan. This Street Tree Manual should be intended for quick reference and use for the general public. Lastly, the Street Tree Manual could be best used as a standard PR tool that is simplified and encourages public involvement.

Sisters School District (Planting Partnership)

Sisters is fortunate to have a citizenry that is active in the natural surroundings and is largely environmentally literate. Students will take their knowledge home and educate their parents, furthering the cause. An educational program could be spearheaded by the city urban forester and aided greatly by the Urban Forestry Board.

COMMUNITY ENGAGEMENT RECOMMENDATIONS

The following action list is a summary of recommendations to promote and strengthen relationships with the community.

Issue	Recommendation	Expected Outcome
Public Education, for the science and understanding of trees	• Create a school program for K12 engagement • Engage Urban Forestry Board to start an urban forest community awareness program • Produce and promote a city tree manual, simplified for the city of Sisters • Promote tree programs local businesses and HOA's • Utilize Arbor Day and other events to promote planting and explain the importance of trees	• Eventually produces a coordinated volunteer workforce • Creates a new generation interested in Urban Forestry • Establishes a more engaged & informed public • Engagement with public answers their questions in simplified manor
Public Education, for the awareness of the Urban Forestry Program	• Publicize tree city design by using social media, city website, and utilizing local marketing companies. Use partner groups to help raise awareness • Host informational workshops • Establish a link on city website where the public can view the city-wide urban forest inventory • Create heritage tree recognition program	• Spotlights a model city that is the leader of tree preservation in Deschutes County • Promotes an urban forestry system that receives monetary and labor support from the community • A more climate, pest, and wildfire resilient urban forest is end result
Outreach for Agencies and Stakeholders	• Establish communication and keep ties with local agencies such as USFS, ODF, Deschutes County Forester, OSU Extension. • Strengthen relationship with SSD and offer counsel • Meet with HOAs to inform and provide assistance for caring for urban forest	• Augments close local ties with agencies that have direct influence on the city, both in proximity and technical expertise • Agencies are the main resource for grants and program support • Other agencies and entities have influence and ability to enforce defensible space requirements

CONCLUSION

Investments in the urban forest offer a cost-efficient expenditure by working symbiotically and reducing stress on other parts of the city infrastructure while offering benefits of their own accord.

The Sisters Urban Forest Management Plan makes recommendations on how to most efficiently make improvements to Sisters' Urban Forestry Program and in turn raise the quality of Sisters' urban forest. Much good work is currently being done and much potential exists for managing Sisters' urban forest. This plan relies heavily on some changes to the program and community involvement. By doing this, the tree infrastructure in Sisters will be healthier and more robust. Incorporating the recommendations made here will create a sustainable, holistic, and healthy urban forest, providing benefits for all who inhabit it.

Investing in the urban forest is a worthwhile endeavor for its citizenry. Maybe more importantly, it is even more valuable for future generations and the climate. Previous generations invested greatly in the planting and management of all the mature trees Sisters now has, and now is the time to continue that legacy.